Remarks:

Applicant has carefully studied the final Examiner's Action mailed 04/14/2009, having a shortened statutory period for response set to expire 07/14/2009, and all references cited therein. The amendment appearing above and these explanatory remarks are believed to be fully responsive to the Action. Accordingly, this important patent application is now believed to be in condition for allowance.

Applicant responds to the outstanding Action by centered headings and numbered paragraphs that correspond to the centered headings and paragraphing employed by the Office, to ensure full response on the merits to each finding of the Office.

Continued Examination Under 37 CFR 1.114

1. Applicant thanks the Office for entering the amendment filed on 02/03/09.

Claim Rejections – 35 USC § 103

2. Applicant acknowledges the quotation of 35 U.S.C. 103(a).

3. Claims 1, 6, 18-27, 30-33 and 36 stand rejected under 35 U.S.C. § 103(a) as being anticipated by Rees. Reconsideration and withdrawal of this ground of rejection is requested.

In its "***Response to Arguments***" below, the Office points out that Applicant's claim language does not provide a clear indication that the first location is distinct from the third location and that the term "remote" simply requires that some distance separates the elements. Applicant has therefore amended all of the independent claims by providing an enhanced definition of the limitation "remote" so that said independent claims clearly do not recite the arrangement of the transmitter and receiver taught by Rees.

Regarding claim 1, said claim as currently amended now recites the remote relationship between the at least one laser, the at least one detector, and said barrier, and the term remote is now defined as requiring a large distance between elements located at distinct positions, thereby clearly distinguishing from the side-by-side transmitter and detector taught by Rees.

Regarding independent claims 6 and 18, said claims are also amended along the same lines of claim 1 for the same reason.

Regarding claim 19, said dependent claim directed to an optical bandpass filter in the context of Applicant's invention is allowable as a matter of law upon allowance of independent claim 18 from which it depends.

Regarding independent claim 20, said claim is also amended in the same manner as claim 1 to clearly define over the contribution of Rees.

Regarding claims 21 and 22, said dependent claims are directed to an electrical signal conditioner in the context of Applicant's invention and are allowable as a matter of law upon allowance of independent claim 20 from which said claims depend.

Regarding claim 23, said dependent claim directed to an optical bandpass filter in the context of Applicant's invention is allowable as a matter of law upon allowance of independent claim 20 from which it depends.

Regarding claims 24 and 26, said dependent claims are directed to a laser that generates multiple optical wavelengths in the context of Applicant's invention and are allowable as a matter of law upon allowance of independent claims 18 and 20 from which said claims respectively depend.

Regarding claims 25 and 27, said dependent claims are directed to a LIDAR that generates multiple optical wavelengths in the context of Applicant's invention and are allowable as a matter of law upon allowance of independent claims 18 and 20 from which said claims respectively depend.

Regarding claims 30, 31, 32, and 33, said dependent claims are directed to multiple telescope receivers positioned at different locations that detect a backscattered optical signal in the context of Applicant's invention and are allowable as a matter of law upon allowance of independent claims 18, 18, 20, and 20 from which said claims respectively depend.

Regarding claim 36, said dependent claim directed to a detector adapted to detect multipath backscatter from a plurality of external remote targets in the context of Applicant's invention is allowable as a matter of law upon allowance of independent claim 1 from which it depends.

Response to Arguments

4. Applicant thanks the Office for fully considering the arguments filed 02/03/09 and for pointing out the need to amend the independent claims to define the term "remote" with enhanced specificity to distinguish the invention over the teachings and suggestions of Rees.

Applicant first comments on the Office's finding that rain or fog serve as obstacles that prevent line of sight communication.

Suppose that three buildings are situated in a line along the same side of a street and that there are trees or buildings on the other side of the street. Laser communication device in building No. 1 wants to communicate with laser communication device in building No. 3. However, direct line-of-sight communication between buildings Nos. 1 and 3 is blocked by building No. 2, said building No. 2 representing a substantially opaque, signal-attenuating barrier or spatial region.

In a horizontal beam routing technique, a laser transmitter is in building No. 1 and a telescope receiver is in building No. 3. The laser transmitter in building No. 1 aims at a tree on the other side of the street. The telescope receiver in building No. 3 is aimed at the laser target area (the same tree) and receives the laser communication signal. In this case, the presence of fog or rain along the laser optical path will attenuate the laser or optical beam, but if the degree of attenuation is small enough, the communication channel will still be successful.

In a vertical beam routing technique, the laser in building No. 1 is aimed upwardly into the atmosphere. The transmitted laser beam can be aimed at a cloud or a distant point. When the ambient atmosphere is cloudless, the laser beam produces backscattered light along the path of the laser beam, similar to that of a visible laser beam seen by viewers in a laser-light show. The receiver telescope in building No. 3 is aimed at the laser beam traversing into the atmosphere, and detects the laser backscattered light from the ambient atmosphere. In this case, the presence of fog or rain along the laser optical path will attenuate the laser or optical beam, but if the degree of attenuation is small enough, the communication channel will still be successful.

Building No. 2 can be any substantially opaque or signal-attenuating spatial region that prevents direct line-of-sight communication between buildings Nos. 1 and 3. The substantially opaque region could also be a localized fog or rain area. However, the presence of the fog or rain spatial area in this sense is not to be confused with the effect of fog or rain on the attenuation along the laser and optical communication path as outlined above.

Rain or fog can be heavy or light, including an infinite number of conditions between the lightest and the heaviest.

Applicant acknowledges that a very heavy rain or fog can severely attenuate a transmitted signal to the extent that Applicant's system cannot operate in an acceptable manner. However, such very heavy rain or fog is not an obstacle from which a signal can be reflected so that a

transmitter and receiver in out of line-of-sight relation to one another can communicate with one another.

A laser beam travels through light or moderate rain or fog with moderate to small levels of attenuation. Fog can be less dense than clouds and the moisture particles that collectively form a light or moderate fog represent no substantial obstacle to laser transmission therethrough. Accordingly, a light to moderate rainfall or fog represents no obstacle and Applicant's system operates in such conditions much as it would in normal weather conditions, *i.e.*, it reflects laser light from remote obstacles as now claimed with a very high degree of precision as mandated by the Office.

An extremely heavy rain or fog in the vicinity of the transmitter prevents acceptable operation of the novel system; however, the novel system does not use such extremely heavy rain or fog as an obstacle that serves as the apex of the claimed "V'-shaped path of travel.

Light may be both simultaneously transmitted and backscattered from rain or fog, with an appropriate attenuation coefficient and a backscatter coefficient, which depends upon the wavelength of the light and the characteristics of the rain or fog. For example, in the near-IR, the transmission of the atmosphere (thin fog/haze) at ground level is about 95% for a 1 km path, and the backscatter from atmospheric aerosols (thin fog/haze) (US Standard Atmosphere) produces an effective target reflectivity of about 0.001% for a range resolved aerosol length of about 10m. A target reflectivity of 0.001% for a mist rain or thin fog does not support the Office's finding that light to moderate rain or fog represents an obstacle that prevents line of sight communication.

Weak backscatter from the atmosphere, known as Rayleigh scatter, is easily seen by a LIDAR system and has been used to measure clouds and stratospheric aerosols at distances of up to 40 km.

The target reflectivity of a hard target (such as a tree or building) is about 10% to 40%.

A very heavy rain or fog can represent a barrier but the ambient or natural gases in the atmosphere such as oxygen and nitrogen do not represent a significant barrier under normal weather conditions; such gases reflect laser light with very low reflectivity.

The larger aerosols in the atmosphere (such as dust, fogs, even rain) can produce greater backscatter, depending upon the degree of concentration of the fog or rain. This backscatter is called Mie scattering.

Both Mie and Rayleigh scatter will attenuate the laser beam. However, for the natural atmosphere and slight haze, the attenuation is less than a few percent.

For heavy fog or rain, the attenuation can be as high as 50% to 100%. In a heavy fog, the backscatter is large, but the attenuation is large, so that the system detection range is small, on the order of one to ten meters at most. An extremely heavy fog or rain can create an attenuation great enough to diminish the laser beam and the backscattered light so that it can not be sensed. Therefore, such heavy rain or fog is not a laser target in the novel system.

By contrast, the Rees system does not include a transmitting laser and a receiving device that are out of line-of-sight relation to one another with an opaque obstacle therebetween and the Rees system does not include a laser aimed at an opaque obstacle so that the laser beam will follow a "V"-shaped path of travel between the transmitter and a receiver. Instead, the Rees system looks straight ahead and the reflected light comes straight back if it is reflected by a very heavy rain or fog. Both the Rees system and Applicant's system can be rendered substantially inoperative by a heavy rain or fog in the vicinity of the transmitter that limits transmission to a very short distance. Both the Rees system and Applicant's system essentially see through normal atmospheric particles and gases. Only Applicant, however, advances the art by employing a transmitter and a receiver that are out of line-of-sight relation to one another so that they can communicate only by means of light reflected from high reflectivity opaque objects such as buildings and trees or light reflected by Mie or Rayleigh backscatter from the ambient atmosphere that follows a "V"-shaped path of travel.

Under normal weather conditions, a laser beam directed up into the sky at a distance of three thousand feet (3000 ft) as a part of the novel system is backscattered from natural aerosols such as fine dust and atmospheric water aerosols back toward the ground, and the backscattered light is detected by another telescope placed at a remote location that is aimed at the same point in the sky. In some cases, a cloud can be used as the reflecting target. Even though natural aerosols (US Standard Atmosphere) have a low reflectivity, the backscattered light can be detected. Many lidar systems use this technique to measure the density of the atmosphere. Thus, even the natural atmosphere has some reflectivity to light, but it is very weak and does not provide the reflectivity of an opaque obstacle such as a building or a tree. The Rees system is never aimed at an opaque object such as a building or a tree; it is aimed ahead of an aircraft at the atmosphere for the purpose of detecting very heavy rain or fog in the path of travel of the

aircraft. Even then, such heavy rain or fog does not provide an obstacle that forms the apex in a "V"-shaped path of travel for a laser beam. The heavy rain or fog simply reflects the light straight back to the aircraft so that the distance between the aircraft and such heavy fog or rain can be determined. Like Applicant's system, the Rees device is also essentially useless if the heavy rain or fog is in the immediate vicinity of the transmitter.

Thus it is understood that the introduction of the effects of rain or fog on the novel system and the Rees system provides a topic of discussion but does not render Applicant's claims unpatentable. Both systems can be rendered inoperative by heavy rain or fog in the vicinity of the transmitter and both systems ignore light to moderate rain or fog. However, when the Rees system detects a very heavy rain or fog a distance in front of an aircraft, the transmitted light reflects from such heavy rain or fog and travels straight back to the transmitter. The position of the aircraft changes only a nominal amount during the very brief moment of time from transmission of a signal and detection of its return. Rees falls far short of suggesting to one of ordinary skill in the art that a heavy rain or fog could serve as an obstacle of sufficient reflectivity so that such heavy rain or fog could serve as the apex in a "V"-shaped path of travel that enables communication between a transmitter and a receiver that are not in line-of-sight relation to one another. That is Applicant's invention, and that fact is independent of any weather condition.

Conclusion

5. Applicant acknowledges that the outstanding action is a final action. A Request For Continued Examination and fee are filed herewith as a separate paper. Claims 1, 6, 18-27, 30-33, and 36 are now in condition for allowance and A Notice of Allowance is solicited. If the Office is not fully persuaded as to the merits of Applicant's position, or if an Examiner's Amendment would place the pending claims in condition for allowance, a telephone call to the undersigned at (813) 925-8505 is requested. Applicant thanks the Office for its continuing careful examination of this important patent application.

Very respectfully,

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Dated: July 14, 2009

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CERTIFICATE OF ELECTRONIC TRANSMISSION
(37 C.F.R. 2.190(b)

I HEREBY CERTIFY that this Amendment G, including Introductory Comments, Amendments to the Claims, Remarks, and a Request for Continuing Examination is being electronically transmitted to the United States Patent and Trademark Office through EFS Web on July 14, 2009.

Dated: July 14, 2009

/jessica powell/
Jessica Powell